REMARKS

In the outstanding Examiner's Action claims 1-13 were examined. As set out in more detail in the Action, various claims were rejected under 35 USC 102(b) as being anticipated by Brown (US 1,574,466), Strizki (US 5,596,845), Dinitz (US 5,474,408) or Dent (US 4,923,319), and the remaining claims were rejected under 35 USC 103(a) as obvious in view of Brown and Glitsch (US 2,525,217), and in view of Brown and Grauel (US 1,704,939).

After careful review of this Examiner's Action, applicant has canceled claims 1 to 5 (inclusive), 7 and 12, without prejudice, and has added new claims 14 to 18 to avoid the above rejections and to more clearly patentably distinguish the invention from the prior art. Accordingly, as discussed below, it is believed that the application is in condition for allowance.

1) Objection to the Drawings

The drawings objections raised by the Examiner have been addressed, namley:

i) Figure 1 has been corrected to remove reference numerals 24 and 30 as they are not mentioned in the specification, as noted by the Examiner. In addition, redundant reference numerals 62 and 64 at the bottom of figure 1 have been removed to correct another drawings error. Reference numerals 62 and 64 already appear at the top of figure 1 to properly identify the recesses in the flanges 42, 44;

ii) Figure 3 has been amended to also remove numerals 24 and 30, and four lines have been inserted to eliminate the c-shaped cross-section identified by the Examiner to correctly show the shoulders 52, as show in figures 1 and 2e; and,

iii) A line 1-1 has been added to figure 4, as described on page 3, line 24.

2) Objections to the Specification

Applicant has amended the specification to address the objections in paragraphs 4 and 5 of the Action. Claims 2, 4, 5 and 7 have been canceled, and "centreline" has been deleted from claim 11.

Applicant has added language to the bottom of page 6 to clarify what is meant by the shear zone 60 being "turned down on a lathe or other machine tool", namely that the shear zone 60 is provided with a radially inwardly curved or bowed profile. This profile is also clearly shown in the figures. Hence, no new matter has been added.

3.0) Rejections based on prior art

3.1) Rejections under 35 USC 102(b)

Regarding the rejections under 35 USC 102(b) as noted above, the current claims have been revised to more clearly patentably distinguish the invention from the cited references. Neither Brown, Strizki, Dinitz nor Dent disclose applicant's claimed invention, namely none of the references disclose:

a shear bolt with an inwardly bowed shear area as claimed in amended independent claim 6;

a shear bolt coupling assembly having a shear bolt with opposed planar surfaces for engaging the slots in the flanges in a close clearance fit to avoid rotation as claimed in amended independent claim 10; and,

a fastening assembly for engaging recessed portions on outside faces of the coupling flanges as claimed in new independent claim 14.

Therefore none of the references anticipates applicant's invention, as claimed. The differences between the applicant's invention and the cited references is further discussed below.

3.2) Rejections under 35 USC 103(a)

It is believed that the revised and new claims define an invention which, taken as a whole, is unobvious over Brown, Strizki, Dinitz, Dent, Glitsch and Grauel, whether these references are considered singularly or in the combinations noted by the Examiner. None of these references, when combined, teach or suggest all the limitations in the current claims.

3.2.1) Revised claims 6, 8 and 9

An important aspect of the present invention, as described in the paragraph starting on page 6, line 13, is the shear zone 60 which is turned down on a lathe to provide an inwardly curved, or bowed, profile. The profile is desireable as it provides a means of reliably attaining a pre-set diameter of the bolt's shear zone, and thus a more precise and predictable shear resistance of the shear bolt. It has been found that, unlike prior art shear bolts with cylindrical (i.e. straight or flat) shear zones, such as those shown in Brown and the other cited references, applicant's profile urges rupture away from the shoulders 52 which can adversely affect the bolt's shear resistance/capacity. Since none of these references disclose nor teach such an advantageous and desireable profile for a shear bolt,

it is respectfully submitted that they therefore do not anticipate nor render obvious applicant's claim 6, nor claims depending therefrom.

3.2.2) New claims 14 to 18

Referring to Brown, that reference teaches a shear-bolt having enlarged shoulders 15d which are adapted to be seated in counterbored portions, or recesses, 10d, 11d on the opposed *inside* faces 10a and 11a of the flanges, as best seen in figs.1, 3 and 5 (these counterbored portions are also indicated in dotted outline in fig.2, although not identified by reference numerals). Since the end nuts 15d have a flush engagement against the outside faces of the flanges, the seated shoulders act to retain the bolt in the flanges upon rupture (col.2, lines 1-26). A problem with this arrangement is that the flanges must be initially spaced further apart in order to install the bolt into the slots 10c, 11c, and the flanges must then be slid toward each other to seat the bolt shoulders 15d in the respective flange recesses. Likewise, upon rupture of the bolt, the ruptured segments of the bolt may not be removed by merely loosening the respective end nuts 15b. Rather, the flanges must first be spread apart sufficiently to disengage the shoulders 15d from the seats. Such spreading of heavy transmission components is undesireable and can be quite difficult if not impossible to perform without proper tools. Further, should one wish to replace one of the shear bolts for inspection or routine maintenance (because the bolt has become too rusty or has otherwise been damaged by road debris, for instance), such task is not possible unless all of the other bolts are first loosened so as to spread the flanges.

In contrast, applicant's shear bolt coupling assembly, as claimed in new claim 14, provides a shear bolt with shoulders that make a flush engagement on the inside faces of the flanges, as best seen in figs. 4 and 4a. Recesses 62, 64 are provided on the *outside* faces of the flanges at each slot 46, 48 for receiving the nut and washer assembly 56, 58 therein to securely retain the bolt in the slots and to prevent the bolt from being urged radially outwardly by centrifugal force, such as during rotation of the coupling assembly and after rupture of the shear bolts (page 7, lines 9-21). Hence, applicant's configuration overcomes the problems with Brown by allowing a shear bolt to be installed with the coupling members already coaxially engaged at a final desired clearance. Applicant's bolt is merely inserted into the ends of the chosen slots 46, 48 with the shoulders 52 sliding over the inside faces of the flanges, and then securely engaged in the recesses 62, 64 via the nut and washer assembly. Likewise, a selected shear bolt 50, whether ruptured or not, may be removed from between the flanges by merely disengaging the nut and washer assembly from the recesses and sliding the bolt out of the slots, without having to spread

the flanges. None of the other cited references disclose such features, either alone or in combination. Hence, it is submitted that claim 14, and claims 15-18 depending therefrom, are patentable over the cited references.

3.2.3) Revised claims 10, 11 and 13

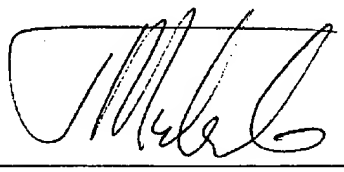
Further to the discussion in 3.2.2 above, applicant also notes that it may be very difficult or virtually impossible in Brown to remove a ruptured segment of the bolt should the end nut 15b bind to the threads of the bolt (such as by rust). In such case, rotation of end nut 15b with a wrench or like tool will cause the ruptured bolt to rotate within the slot since the shoulder remains seated within its recess. Trying to keep the shoulder from rotating with a hand tools would be virtually impossible, and so one would need to resort to other more complex, costly and time consuming processes for bolt removal. These processes would require those segments of the transmission associated with the flanges 10, 11 to be completely disengaged, and expose them to potential damage during attempts at removing the sheared bolt. This undesireable rotation of the shear bolt after rupture within a circular bore, and consequent inability to remove the ruptured bolt, is not only a problem in Brown but in the other prior art references as well.

None of the cited references teach applicant's solution to the problem, namely providing opposed planar surfaces 54 on the shear bolt for engaging the slots 46, 48 in a close clearance fit to avoid rotation of the shear bolt. Referring specifically to Glitsch, as cited by the Examiner, that reference in fact teaches away from applicant's solution. In Glitsch the flat sides 12 of the bolt 11 fit snugly into the openings 14 in the washers 15, but the bolts must be inserted into an opening B^1 "large enough to permit the body 11 to **freely rotate** therein" (col.2, lines 1-2). The bolt 11 is specifically designed to rotate together with the washers within such opening so as to engage and disengage the washers with the edge of a plate, such as a manway cover A, as shown in the two positions of the washer on the left side of fig.1 (see col.2, lines 14-25 and 48-52). Fixing the bolt's rotation in an opening would defeat the purpose of Glitsch's invention. Hence, combining Glitsch with Brown does not lead to applicant's invention as claimed in claim 14, but in fact teaches away from such invention. The problem is not solved by any of the other cited references as well. Surely, if it were so obvious to solve such an important problem for shear bolt coupling assemblies with applicant's relatively simple but effective solution, then the prior art shear bolts would incorporate applicant's inventive feature rather than suffer the noted disadvantages. Hence, it is submitted that claim 10, and claims 11 and 13 depending therefrom, are patentable over the cited references.

The other prior art referred to in the Examiner's Action has been reviewed but is not sufficiently relevant to the claims, as amended, to warrant detailed comment.

In view of the above amendments and the discussion relating thereto, it is respectfully submitted that the present application, as amended, is in condition for allowance. Favorable reconsideration of the rejections and objections is therefore requested.

Respectfully submitted,

By: 

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Version with markings to show changes made to the specification

An important aspect of the invention are the shear bolts 50. Each shear bolt 50 fits through the respective slots 46 and 48 of both flanges 42 and 44 concurrently, with the shoulders 52 of the bolt 50 contacting the inside of the flanges 42 and 44. Referring in particular to figures 2 to 2e, each bolt 50 has two opposed flat sides 54 which are a suitable distance apart to form a close clearance fit inside the slots 46 and 48 to allow easy installation and/or replacement and to prevent the shear bolt 50 from rotating within its slot when threaded hex nuts 56 are installed. When the shear bolts 50 are inserted into the radial slots 46 and 48 on the flanges 42 and 44, flat washers 58 and lock nuts 56 (or other suitable fasteners) are assembled onto both ends of the shear bolts 50 (see figs.1, 3 & 4a). The nuts 56 are tightened to draw the flanges 42 and 44 together until the shoulders 52 of the shear bolts 50 are in close contact with the inside of the coupler flanges 42 and 44. In doing so, the flanges 42 and 44 are held at a set distance "X" from each other and are securely connected to one another. The shear bolt 50 also has a shear area 60 or zone between the shoulders 52. This shear zone 60 is turned down on a lathe or other machine tool in a radially inwardly curved shape, or bowed profile, as best seen in figures 2, 2e and 4a, in such a way as to provide a shear area that is both much more susceptible to shearing or rupture than the rest of the shear bolt 50 or any other part of the entire coupling device10 or drive train, and is of a pre-set and controllable diameter to achieve a desired ultimate shear torque of the entire coupling device 10. Hence, one can accurately control the maximum torque at which the bolts 50, and hence the coupling device 10, will shear to break the rotatable connection or link between the drive shaft sections 16, 18 so as to avoid damage to the drive shaft from an over-torque situation. The bolts are therefore the equivalent of fuses in an electrical device.

Version with markings to show changes made to claims

6.(once amended) A shear bolt for joining coupling members comprising:

an elongate core element having a first portion with an inwardly bowed profile forming a shear area of a given shear strength, a second portion on each side of said first portion forming a shoulder of larger diameter than said first portion and adapted to provide a pre-set spacing between opposed coupling members at least in the vicinity of said shear bolt, and a third portion extending from each of said shoulders adapted to receive a fastening member to secure said core element with said coupling members.

8.(once amended) The shear bolt of claim [7] 6 wherein said [shaped part] third portion includes opposed planar surfaces adjacent said second portion for slideably engaging a coupling member transversely thereto in a close clearance fit to avoid rotation of said core element during installation and removal of said fastening member.

9.(once amended) The shear bolt of claims 6 [, 7] or 8 further including a washer element having an opening for insertion onto said third portion and adapted to register with a correspondingly shaped recess in a coupling member, wherein the location of said opening in said washer element provides a means of adjusting the spacing of said bolt element from a given radial reference point of said coupling members.

10.(once amended) A shear bolt coupling assembly comprising:

[a] first and second coaxially engaged coupling members with respective [a] first and second [radially extending] flanges, each flange having a plurality of radially extending open-ended slots along a perimeter thereof;

[a second coupling member located coaxially with said first coupling member and having a second radially extending flange;] and,

an elongate shear bolt having a first portion forming a shear area of a given shear strength, a second portion on each side of said first portion forming a shoulder of larger diameter than said first portion for abutting each of said first and second flanges to provide a desired clearance therebetween, and a third portion extending from each of said shoulders adapted to receive a fastening member to secure said shear bolt with said first and second flanges[,] and thereby securely connect[ing] said first and second coupling members for transferring a shear force therebetween up to said given shear strength , said third portion including radially opposed planar surfaces adapted to engage said slots in a close clearance fit therewith to avoid rotation of said shear bolt therein .

11.(once amended) The assembly of claim 10 wherein said [third portion includes a shaped part adjacent said second portion for slideably engaging a respective first or second flange transversely to a longitudinal centreline of said first and second coupling members] first portion of said shear bolt has an inwardly bowed profile .

13.(once amended) The assembly of claims 10 [,] or 11 [or 12] further including a washer element having an opening for insertion onto said third portion and adapted to register with a correspondingly shaped recess in a respective first or second flange, wherein the location of said opening in said washer element provides a means of adjusting the radial spacing of said shear bolt from a given radial reference point of said first and second coupling members.

Clean version of all pending claims

WE CLAIM:

6. A shear bolt for joining coupling members comprising:

an elongate core element having a first portion with an inwardly bowed profile forming a shear area of a given shear strength, a second portion on each side of said first portion forming a shoulder of larger diameter than said first portion and adapted to provide a pre-set spacing between opposed coupling members at least in the vicinity of said shear bolt, and a third portion extending from each of said shoulders adapted to receive a fastening member to secure said core element with said coupling members.

8. The shear bolt of claim 6 wherein said third portion includes opposed planar surfaces adjacent said second portion for slideably engaging a coupling member transversely thereto in a close clearance fit to avoid rotation of said core element during installation and removal of said fastening member.

9. The shear bolt of claims 6 or 8 further including a washer element having an opening for insertion onto said third portion and adapted to register with a correspondingly shaped recess in a coupling member, wherein the location of said opening in said washer element provides a means of adjusting the spacing of said bolt element from a given radial reference point of said coupling members.

10. A shear bolt coupling assembly comprising:

first and second coaxially engaged coupling members with respective first and second flanges, each flange having a plurality of radially extending open-ended slots along a perimeter thereof; and,

an elongate shear bolt having a first portion forming a shear area of a given shear strength, a second portion on each side of said first portion forming a shoulder of larger diameter than said first portion for abutting each of said first and second flanges to provide a desired clearance therebetween, and a third portion extending from each of said shoulders adapted to receive a fastening member to secure said shear bolt with said first and second flanges and thereby securely connect said first and second coupling members for transferring a shear force therebetween up to said given shear strength, said third portion including radially opposed planar surfaces adapted to engage said slots in a close clearance fit therewith to avoid rotation of said shear bolt therein .

11. The assembly of claim 10 wherein said first portion of said shear bolt has an inwardly bowed profile.

13. The assembly of claims 10 or 11 further including a washer element having an opening for insertion onto said third portion and adapted to register with a correspondingly shaped recess in a respective first or second flange, wherein the location of said opening in said washer element provides a means of adjusting the radial spacing of said shear bolt from a given radial reference point of said first and second coupling members.

14. A shear bolt coupling assembly comprising:

a first coupling member with a first radially extending flange having an inside face, an opposed outside face and a plurality of radially extending open-ended slots along a perimeter thereof, each slot having a recessed portion on said outside face;

a second coupling member with a second radially extending flange having an inside face, and an opposed outside face and a plurality of radially extending open-ended slots along a perimeter thereof, each slot having a recessed portion on said outside face,

wherein said first and second coupling member are coaxially engaged so as to position said inside faces in a facing relationship;

an elongate shear bolt having a first portion forming a shear area of a given shear strength, a second portion on each side of said first portion forming a shoulder of larger diameter than said first portion for flush engagement with said inside face of each of said first and second flanges to provide a desired clearance therebetween, and a third portion extending from each of said shoulders adapted to receive a fastening assembly to secure said shear bolt in aligned slots in said first and second flanges and thereby securely connect said first and second coupling members for transferring a shear force therebetween up to said given shear strength, said fastening assembly being insertable into a respective recessed portion and including a stop means for preventing said shear bolt from being urged radially out of said aligned slots by centrifugal force, and said shear bolt being removable from said coaxially engaged coupling members without increasing said desired clearance upon disengaging said fastening assemblies from said recessed portions.

15. The assembly of claim 14 wherein said stop means comprises a washer element adapted to register with said recessed portion.

16. The assembly of claim 14 wherein said shear area is formed by a first portion having a radially inwardly curved profile.

17. The assembly of claim 15 wherein said shear area is formed by a first portion having a radially inwardly curved profile.

18. The assembly of claims 14, 15, 16 or 17 wherein said third portion of said shear bolt includes opposed planar surfaces adjacent said second portion for slideably engaging said slot in a close clearance fit to avoid rotation of said shear bolt therein.